Title: METHOD AND APPARATUS FOR DRY-ETCHING HALF-TONE PHASE-SHIFT FILMS, HALF-TONE PHASE-SHIFT PHOTOMASKS AND METHOD FOR THE PREPARATION THEREOF, AND SEMICONDUCTOR CIRCUITS AND METHOD FOR THE FABRICATION THEREOF Inventor: Takaei SASAKI et al Appln. No.: New Application Docket No.: 101136-00101

Fig. 1

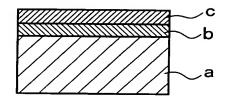
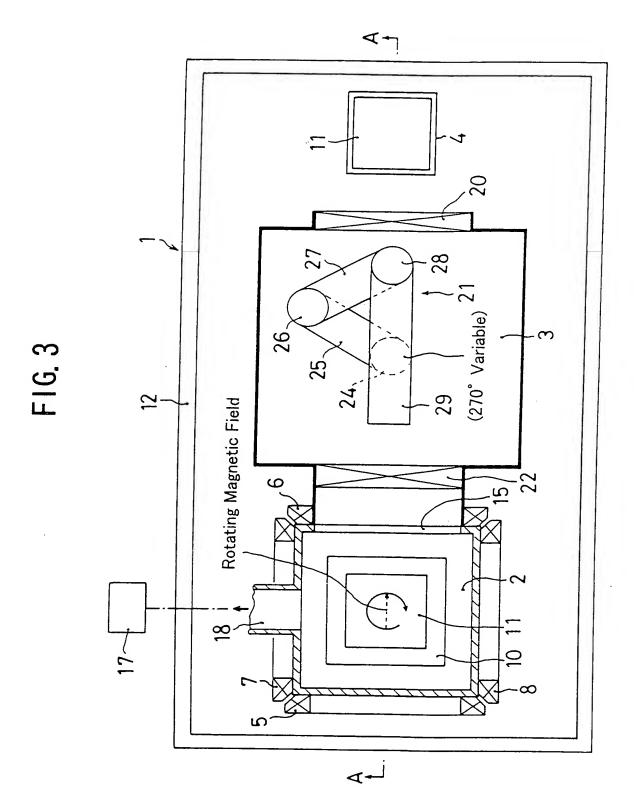


Fig. 2

Flow	Electron Beam Patterning Process	Laser Beam Patterning Process
Receipt of Blank		
Exposure/Patterning	Electron Beam Patterning Device	Laser Beam Patterning Device
V	Spray, Dip, Paddle Systems	
Development	Organic Solvent Development Alkali Development	,
Post-Baking	Hot Plate Oven Convection Oven	Generally, any treatment is not required.
De-scumming	Plasma De-scumming Device	Generally, any treatment is not required.
CrEtching	Wet Etching and Dry-Etching	
Removal of Resist	Solvent Pealing, Ashing	Exposure of Whole Surface/Alkali Pealing, Solvent Pealing, Ashing
Washing	Sheet-Fed Acid-Treatment, Physical Scrubbing, or the like	
To Inspection Step		

2/7

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Appln. No.: New Application Docket No.: 101136-00101

4 / 7

Fing. 5 A

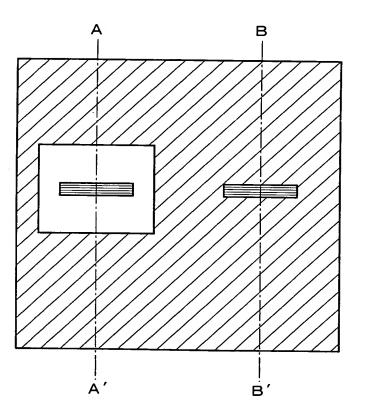
Completely Removed Pattern (Periphery of the Dimension-Evaluation Pattern)

Dimension-Evaluation Pattern (L/S, Isolated L, Isolated S)

20mm

20mm

Fing. 5B



←Dense Portion→←Coarse Portion→

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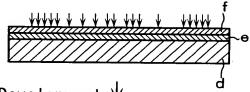
Fing. 6 A

Fing. 6B

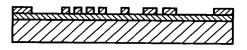
Test Pattern on Dense Portion(A-A')

Test Pattern on Coarse Portion(B-B')

(a) EB Patterning



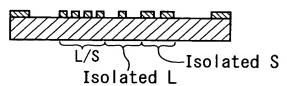
(b) Development ¥



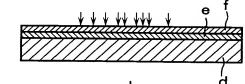
(c) Etching



(d) Removal of Resist

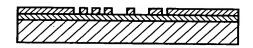


(a) EB Patterning



(b) Development

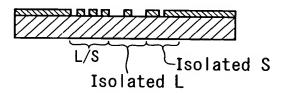
√



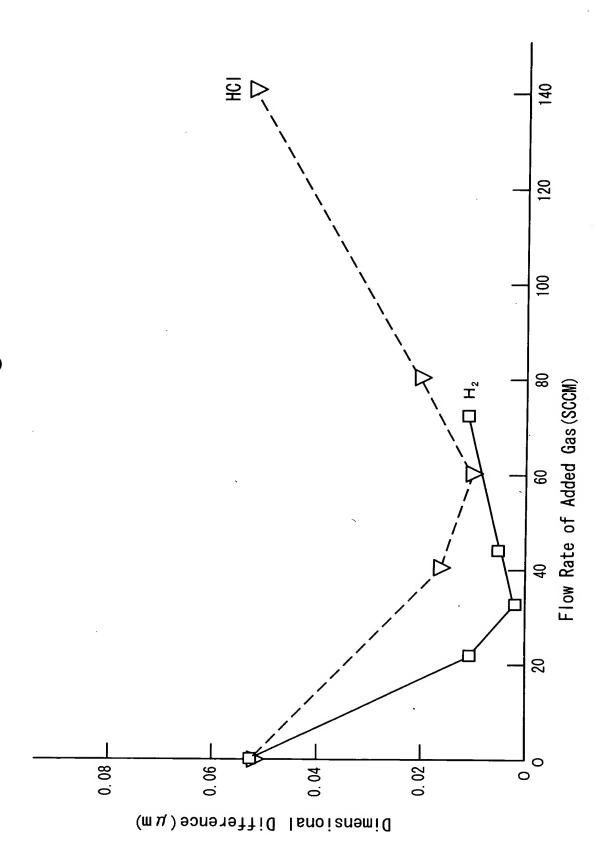
(c) Etching



(d) Removal of Resist







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Fig. 8

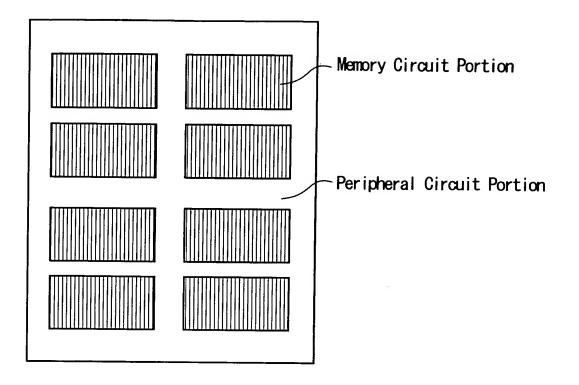
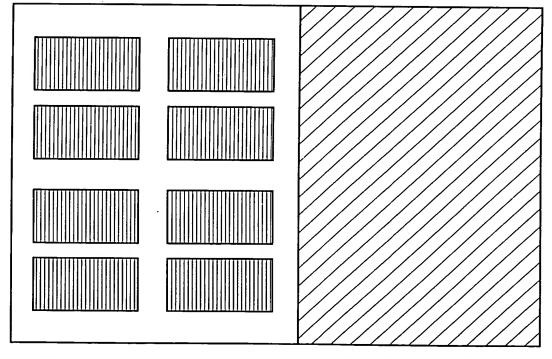


Fig. 9



Memory Circuit Portion

Logic Circuit Portion